Specification

PRINTING MACHINE COMPRISING A FORMER

The invention relates to a printing press in accordance with the preamble of claim 1 or 2.

A folding structure of a printing press is known, for example, from W. Walenski "Der Rollenoffsetdruck" [Rotary Offset Printing], 1996, pages 186 and 187, in which a web of material is cut into two partial webs, during the further course of production the partial webs are placed on top of each other and cut in the center or are again longitudinally cut. In such a case, according to Walenski, page 81, the width of the pages of four webs imprinted side-by-side would be a quarter of the width of the printing cylinder or slightly less if a web of lesser width than that of the printing cylinder is to be imprinted.

If the number of pages of a printed product to be produced is not sufficient to fill four pages side-by-side, the plate cylinder can also be equipped with a reduced number of printing plates for printing a web of three-quarter or half or quarter width side-by-side with three, two or one side. Here, at least a quarter of the width of the plate cylinder, and therefore a quarter of the production capacity of the press remains unused in each case.

If such a press is to be used for semi-commercial printing in particular, jobs with unfavorable page formats can appear, wherein four pages side-by-side are wider than the plate cylinder, or wherein with four pages side-by-side the width of the plate cylinder is only insufficiently utilized, but wherein twice the number of pages exceeds the width of the plate cylinder.

EP 0 814 044 A1 discloses a web guidance of several partial webs cut by means of a longitudinal cutting device in the direction to a former, which is oriented in such a way that its entry direction extends transversely in respect to the web running direction in the area of the longitudinal cutting device.

DE 20 39 544 B shows a web guidance in a printing press having a longitudinal cutting device which is positioned in such a way that it cuts the web into a 1/3 and a 2/3 partial web. The two partial webs are conducted to a former which can be moved transversely in respect to the web running direction.

The object of the invention is based on providing a printing press with an improved utilization of the web width.

In accordance with the invention, this object is attained by means of the characteristics of claim 1 or 2.

In contrast to known printing presses, wherein the longitudinal division of an original web of material into partial webs of one or two thirds of the original width is only intended in connection with webs of material or webs which originally were three quarters wide, i.e. webs which maximally cover three quarters of the width of the plate cylinder, such a printing press is designed for providing such a three quarter division also in connection with wider webs. In the optimum case the entire width of the plate cylinders is used for printing a number of side-by-side pages which can be divided by three.

In this case at least one of the partial webs can be conducted through a former. In the course of passing through the former the web of material is folded in the center. It is possible to provide at least one longitudinal cutting device in an apex of the former for cutting at least one folded partial web in the longitudinal direction of its fold line.

The printing press preferably has a transverse cutter for cutting the partial webs into signatures.

The printing press can also be provided with a folding apparatus. The folding apparatus can be, for example, a transverse folding apparatus, such as a folding jaw cylinder or some other known device for transverse folding. In this case the transverse cutter can be a cutting blade cylinder placed against a folding jaw cylinder of the folding apparatus.

Moreover, for producing stapled products the printing press can have a stapling device for stapling signatures.

Exemplary embodiments of the invention are represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a schematic representation of a portion of a known printing press,

Fig. 2, a schematic representation of a portion of a first printing press,

Fig. 3, a schematic representation of a portion of a second printing press,

Fig. 4, a schematic representation of a portion of a third printing press.

A portion of a known printing press in the course of performing a semi-commercial printing job is schematically represented in Fig. 1. Products of a lateral width of 8 inches (203.2 mm) are produced from a web 01 of material, in particular a paper web 01, or web 01, of a width of 32 inches (812.8 mm) by means of the printing press. The web 01 of material is conducted over a printing cylinder 02, for example a forme cylinder 02, which is rotatably seated in a frame 03 and which directly can be

a plate cylinder 02 or, in an indirect printing process, a transfer cylinder 02 which rolls off in contact with a plate cylinder 02. A counter-pressure cylinder which presses the web 01 of material against the printing cylinder 02 is not represented in Fig. 1. For imprinting the web 01 of material, the circumference of the plate cylinder 02 is equipped with two sets of printing plates, wherein each set is four printing plates wide. Therefore eight fields A, B, C, D, E, F, G, H, respectively corresponding to a printing plate, are imprinted on the web 01 of material in the course of each full revolution of the plate cylinder 02. The fields A, B, C, D are here printed by the printing plates of the first set, while the fields E, F, G, H are printed by the printing plates of the second set. In Fig. 1 the fields A, B, C, D, E, F, G, H, which are imprinted on the web 01 of material during each revolution of the printing cylinder, are indicated by means of diagonally crossed rectangles.

The web 01 of material is conducted over a turning bar 04 into a former 06, in which it is folded longitudinally along the center. Besides the former 06, the effect of the former 06 on the fields A, B, C, D, E, F, G, H is illustrated in Fig. 1. A longitudinal fold is created between the fields B and C and between the fields G and F.

Following the former 06, a longitudinal cutting device 07 is arranged in an apex of the former 06. It can be switched in as needed in order to cut the web 01 of material along the longitudinal fold into two partial webs of identical width placed on top of each other. These are divided into signatures with two sheets in a transverse cutter 09, constituted by a cutting blade cylinder and a counter-pressure cylinder, which rotate together. A first one of these sheets comprises the fields A, B, C, D, and a

second one of these sheets comprises the fields E, F, G, H. In these signatures the sheets lie on top of each other in such a way that the fields A and D, B and C, E and H, as well as F and G are respectively congruent, as can be seen in the small representation next to the transverse cutter 09.

The signatures arrive at a cylinder 08, for example a spur needle and folding blade cylinder 08 which, in a manner known per se, is provided with spur strips or grippers for holding the signatures, as well as with folding blades. The signatures are transferred by the spur needle and folding blade cylinder 08 to a cylinder 11, for example a folding jaw cylinder 11, which has been placed against the spur needle and folding blade cylinder 08. In the course of this, transverse folding of the signatures is performed with a transverse fold line in the first sheet between the fields A and E, as well as between B and F, and in the second sheet between the fields C and G and between D and H. This is shown in the small drawing figure next to the cylinders 08, 11.

A transverse cutter 13, which is equivalent to the transverse cutter 09, adjoins the cylinders 08, 11 and cuts the signatures along the transverse fold edges. The result is four sheets placed on top of each other, each with respectively two fields. Here, too, a small drawing shows the situation following the passage through the transverse cutter 13. Here, the sheet shown on top comprises the fields G and H.

Then a folding apparatus 12 follows, in which the signatures are once more longitudinally folded. Here, the longitudinal fold takes place between the respective fields of the sheets of the signature, which is also illustrated by a small drawing. In this way products with four longitudinally folded sheets and 16 pages are made.

As can be seen in Fig. 1, the printing press is laid out for processing wider webs of material than the present web 01 of material of a width of 32 inches. An unused projection of the printing cylinder 02 of a usable width b02 of its barrel remains on both sides of the web 01 of material. The width, or usable width b02 of the cylinder 02 should be understood to be its width which represents a maximum printing or ink transfer area. With the transfer cylinder, for example, this can be the maximum width which can be covered with transfer blankets, and with forme cylinders the maximal width which can be covered with print images. Not included in this are journals, a possibly additionally provided bearer ring width or other auxiliary devices. The usable width substantially also corresponds to a maximum web width possible to be processed, width b_{max} of the web 19 maximally to be processed (see Fig. 2). The maximum web width, width b_{max}, is either negligibly less than the width b02 of the cylinder 02 embodied as forme cylinder 02 or, in the extreme case, corresponds to it. If it were intended to produce a product of a page width of 8 inches from a wider web of material by means of the represented printing press in order to also utilize this projection, this wider web of material would have to be wider by four pages of the product, i.e. would have to have a total width of 64 inches (1,625.6 mm). However, with this it would exceed the width of the printing cylinder 02 and could no longer be processed in the represented printing press. Therefore, with the represented printing press the production of a product of 8 inch page width is tied to the use of a web 01 of material of a maximum web width of 32 inches, wherein moreover a large projection of the printing cylinder 02 on both sides of the web 01 of material must be accepted.

A corresponding portion of a printing press is schematically represented in Fig. 2. Here, the same reference symbols identify identical components as in Fig. 1. In contrast to Fig. 1, a wider web 19 of material of a width of 48 inches (1,219.2 mm) is processed in the instant printing press. Again two sets of printing plates arranged over the width have been attached to the plate cylinder 02, however, here the sets comprise n = 6 printing plates per set. In this case the number of printing plates n of a set, i.e. the number of pages over the width, has been selected in such a way that n is a whole number divisible by 3. In this way twelve fields A, B, C, D, E, F, G, H, I, J, K, L per revolution of the printing cylinder 02 are imprinted on the web 19 of material, namely the fields A, B, C, D, E, F by the printing plates of the first set, and the fields G, H, I, J, K, L by the printing plates of the second set.

A longitudinal cutting device 17 is provided, which cuts the web 19 of material into a wide partial web 14 and a narrow partial web 16. The wide partial web 14 has a width of 32 inches, which corresponds to two-thirds of the width of the web 19 of material, and the partial web 16 has a width of 16 inches (406.4 mm), which corresponds to one third of the width of the web 19 of material. If the fields A, B, C, D, E, F, G, H, I, J, K, L imprinted by a set of printing plates are consecutively numbered from the bottom to the top in the drawing, the longitudinal cutting device 17 has been placed on a boundary between the second and third field, i.e. between fields E and D of the fields A, B, C, D, E, F imprinted by the first set of printing plate, and between the fields K and J of the fields G, H, I, J, K, L imprinted by the second set of printing plates. Therefore the

fields A, B, C, D, G, H, I, J are part of the wide partial web 14, while the fields E, F, K, L are part of the partial web 16.

The wide partial web 14 is conducted over a turning bar 04, while the narrow partial web 16 is conducted over a second turning bar 18 in such a way that both partial webs 14 and 16 pass through the former 06, in which the wide partial web 14 is folded in the center between the fields H and I and between the fields B and C. The partial web 16 passes through the former 06 without being changed. The same as Fig. 1, Fig. 2 is also provided with small drawings on the side for making the position of the fields A, B, C, D, E, F, G, H, I, J, K, L during the various process steps clear. In the case of the printing press represented in Fig. 2, the folded partial web 16 encloses the partial web 14 after passage through the former 06. However, it is also possible for the partial web 14 to be conducted outside the folded partial web 16.

At least one of the two turning bars 04, 18 (in this case at least 04), but advantageously both turning bars 04, 18, has, or have, an effective length for the deflection of at least two-thirds of the width b_{max} of the partial web 14 maximally corresponding to the web 19 to be processed. The effective length here is understood to be the resultant length from the projection of the incoming partial web onto the turning bar 04, 06 inclined by 45° or 135° in respect to the entry direction, i.e. the length which is required for deflecting the respective partial web 19 (here of three quarter width). If both turning bars 04, 18 are embodied in this way, the variability regarding the assignment of

the two-thirds wide partial web 14 to the turning bar 04 or 18 and/or to the cutting line between D and E or between B and C is increased.

Following the passage through the former 06, the partial web 14, which is now folded, is transversely cut at the fold location by the longitudinal cutting device 07, the same as in the previous example so that, in contrast to the printing press in Fig. 1, in the present printing press three partial webs placed on top of each other of respective widths corresponding to two pages of 16 inches (50.8 mm) are transferred to the traverse cutter 09. Further processing takes place analogous to the printing press in Fig. 1. A longitudinally folded signature with six sheets and 24 pages leaves the printing press as the finished product.

In contrast to the known printing press in Fig. 1, by means of processing a wider web 19 of material it is therefore possible for the present printing press to make a product which also has a page width of 8 inches. The products has a larger number of sheets and pages. Therefore the printing press is also more efficient in regard to the amount of product pages it produces per cylinder revolution than the printing press from Fig. 1. Furthermore, with the printing press the projection of the cylinder 02 on both sides of the web 19 of material is reduced, so that the printing press is utilized much more effectively than the known printing in Fig. 1.

A second embodiment of a printing press is represented in Fig. 3. The printing press in Fig. 3 has two longitudinal cutting devices 17 and 21, which cut the web 19 of material into three partial webs 22, 23, 24 of identical width. As in the previous example, the longitudinal cutting device 17 has been placed at the

boundary between the second and third fields, i.e. between fields E and D and between fields J and K, while the longitudinal cutting device 21 has been placed at a boundary between the fourth and fifths fields, i.e. between fields B and C and between fields H and I. Each width of the partial webs 22, 23, 24 corresponds to two printing plates of two pages in width. The partial web 22 comprises the fields A, B, G, H,, the partial web 23 the fields C, D, I, J, and the partial web 24 the fields E, F, K, L.

The partial web 22 is conducted over the turning bar 04, the partial web 23 over the turning bar 26 and the partial web 24 over the turning bar 18, wherein all three partial webs 22, 23, 24 subsequently pass through the former 06. In contrast to the printing press in Fig. 2, no longitudinal cutting device is required following the former 06, the partial webs 22, 23, 24 are only folded along the center in the former 06 and are cut into signatures in this state by the transverse cutter 09 and are then transferred to the spur needle and folding blade cylinder 08. Here the signature is transversely folded, the same as in the previous examples. After this the signature is cut open at the transverse fold by the transverse cutter 13. The printing press represented in Fig. 3 delivers two longitudinally folded signatures simultaneously, each of which comprises three sheets and twelve pages.

Finally, a modification of the printing press in Fig. 3 is represented in Fig. 4 wherein, following the former 06, a longitudinal cutting device 07 is provided, the same as in Figs. 1 and 2, which cuts the partial webs 22, 23, 24 after they leave the former 06. This produces six partial webs placed on top of each other. A transverse cutter 09 placed against the spur needle and folding blade cylinder 08 cuts the six partial webs into

signatures with six sheets. A stapling apparatus 27, also placed against the spur needle and folding blade cylinder 08, staples the sheets of a signature together along a line on which the signature is transversely folded in the course of being transferred to the folding jaw cylinders 11. The finished product has six sheets stapled together and 24 pages.

The printing press in Fig. 3, as well as the printing press in Fig. 2, processes a 48 inch wide web 19 of material and thus has the same advantages as the printing press in Fig. 2, namely a good utilization of the printing press and the possibility of creating products with a larger number of sheets of a given page width of the product of 8 inches than with the known printing press in Fig. 1.

In a generalization of the inventive concept, a printing press with at least one forme cylinder 02 for imprinting a web 01, 19 of material and having at least one longitudinal cutting device 07, 17, 21 for cutting the web 01, 19 of material into partial webs 14, 16, 22, 23, 24 is provided, wherein the forme cylinder 02 is is equipped with printing plates for n pages in width, wherein n is a natural number divisible by three, wherein n pages are less in width and n+1 pages are larger in width than a width of the forme cylinder 02, and wherein the longitudinal cutting device 17, 21 can be placed on a boundary between a k-th and a k+1-th page, wherein k is one or two thirds of n.

In the embodiments mentioned, the former 06 is preferably oriented in such a way that its direction of entry extends transversely in respect to the web running direction in the area of the longitudinal cutting device 17, 21, and/or its entry direction for the partial web 14, 16, 22, 23, 24, viewed from above, substantially extends parallel in respect to the

longitudinal axis of the former cylinder 02. In contrast to a straight guidance along, or parallel to the alignment M of the press, the partial web 14, 16, 22, 23, 24 is rerouted by approximately 90° in respect to this alignment. Preferably each imprinted web 01, 19, or partial web 14, 16, 22, 23, 24 undergoes only one such directional change from the press alignment on its way from the printing group to the former 06. Simple deflections by means of deflection rollers with axes of rotation which are perpendicular in relation to the entry direction are excluded from this.

Because of the arrangement of the former 06 which is turned by 90° in respect to the alignment M of the press, and because of the odd numbered, in particular one-time, deflection of the partial webs 14, 16, 22, 23, 24, it is possible in an advantageous embodiment to embody the former 06 stationary in respect to a direction transversely to the incoming partial web 14, 16, 22, 23, 24, i.e. lateral positioning of the former 06 is not necessary.

In connection with all of the above exemplary embodiments, the former 06 can advantageously have an effective width b06 of at least half the width b_{max} of the maximum web 01 to be processed. In other words, the former 06 has an effective width b06 of at least half a usable barrel length (usable width b02) of the forme cylinder 02. Preferably the former 06 even has an effective width b06 of at least three-quarters of the usable width b02 (i.e. barrel length) of the forme cylinder 02, or of the maximum width b_{max}. Furthermore, however, the former 06 preferably is embodied to be narrower than the entire usable width b02 (i.e. the barrel length) of the forme cylinder 02, or of the maximum width b_{max}. In this case the effective width 06 of the former 06 is to be understood as the width of the former 06 transversely in respect

to the entry direction in the area of the run-up of the partial webs 14, 16, 22, 23, 24.

So that, with a varying web or partial web width, the partial webs 14, 16, 22, 23, 24 running up on the former 06, which is turned by 90°, can be correctly laterally aligned, the turning bars can be moved horizontally or in the plane of the incoming and/or outgoing web in such a way that, with webs 01, 19 of different widths, the partial webs 14, 16, 22, 23, 24 made from them can be correctly aligned in respect to each other and/or to the former tip.

The longitudinal cutting device 07 for longitudinally cutting in the area of the fold back can, in a non-represented embodiment of Figs. 2 and 4, be arranged, instead of upstream of the former 06, also in the area of a traction roller arranged upstream of the former 06.

List of Reference Symbols

01	Web of material, paper web, web
02	Print cylinder, forme cylinder, plate cylinder, transfer cylinder
03	Frame
04	Turning bar
05	-
06	Former
07	Longitudinal cutting device
08	Cylinder, spur needle and folding blade cylinder
09	Transverse cutter
10	-
11	Cylinder, folding jaw cylinder
12	Folding apparatus
13	Transverse cutter
14	Partial web, wide
15	-
16	Partial web, narrow
17	Longitudinal cutting device
18	Turning bar
19	Web of material
20	-
21	Longitudinal cutting device
22	Partial web
23	Partial web
24	Partial web
25	-
26	Turning bar

27	Stapling apparatus
b02	Width 02
b06	Width 06
b_{max}	Maximum width of the web
A	Field
B	Field
C	Field
D	Field
E	Field
F	Field
G	Field
H	Field
I	Field
J	Field
K	Field
L	Field